Claims:

1.   A process for detecting and distinguishing, respectively, parts in a material flow which influence an electromagnetic alternating field, comprising the generation of an electromagnetic alternating field extending across the width of the material flow, the generation of a relative motion between the electromagnetic field and the material flow, and the detection of a phase signal portion (PS) and an amplitude signal portion (AS) of a detection signal (DS) by means of a detector coil (4) comprising two windings (4a, 4b) connected inversely, which detector coil is arranged in the effective range of the electromagnetic alternating field, with the detection signal (DS) being derived from a variation of magnetic flux caused by the relative motion between the electromagnetic alternating field and a part located in the material flow and influencing the electromagnetic alternating field, characterized in that a locus curve (15, 20, 30) is formed from the progression of the detection signal (DS) by plotting the progressions of the phase signal portion (PS) and the amplitude signal portion (AS) of the detection signal (DS) as pairs of variates at the respective points of time in a system of coordinates and that the locus curve (15, 20, 30) is evaluated with respect to material-specific characteristics and an identification signal (ES) is emitted upon detection of a material-specific characteristic.

2.   A process according to claim 1, characterized in that the system of coordinates in which the locus curve (15, 20, 30) is formed is a cartesian or polar system of coordinates.

3.   A process according to claim 1 or 2, characterized in that the absolute value of the phase signal portion (PS) and/or the amplitude signal portion (AS) of the detection signal (DS) is used for forming the locus curve (15, 20, 30).

4.   A process according to any of the preceding claims, characterized in that the amplitude signal portion (AS') is adjusted via a nonlinear characteristic curve.

5.   A process according to any of the preceding claims, characterized in that the evaluation of the locus curve (15, 20, 30) is performed using an image processing method.

6.   A process according to any of the preceding claims, characterized in that the evaluation of the locus curve (15, 20, 30) is performed using a pattern recognition method.

7.   A process according to claim 6, characterized in that the pattern recognition method comprises the comparison with a predetermined, optionally adjustable, material-specific

curve or a family of curves, wherein the individual curves of the family of curves preferably represent different purities, geometries or sizes of the detected part influencing the electromagnetic alternating field.

8.   A process according to claim 7, characterized in that the comparison of the formed locus curve (15, 20, 30) with a predetermined curve or family of curves includes the detection of at least one measured value of similarity and the comparison of the at least one measured value with at least one set value.

9.   A process according to any of claims 1 to 3, characterized in that the evaluation of the locus curve includes the determination of the position of characteristic points of the locus curve, preferably the inflection points (15a, 15b; 21; 31, 32) or extrema (15c) thereof, and the comparison of these positions with standard positions or limiting values or fringe ranges (16a, 16b), respectively.

10.   A process according to any of the preceding claims, characterized in that the identification signal (ES) is configured as a material-specific identification signal.

11.   A process according to any of the preceding claims, characterized in that the identification signal (ES) activates means for the separation of the detected part influencing the electromagnetic alternating field from the material flow.

12.   A process according to any of the preceding claims, characterized in that a plurality of detector coils (4) are arranged across the material flow, whose detection signals are evaluated independently of each other by the formation and evaluation of locus curves.

13.   A device for detecting and distinguishing, respectively, parts in a material flow which influence an electromagnetic alternating field, comprising an oscillator (1) and at least one transmitting coil (2) for generating an electromagnetic alternating field extending across the width of a conveying distance of the material flow, at least one detector coil (4) comprising two windings (4a, 4b) connected inversely for detecting the electromagnetic alternating field and for generating a detection signal (DS) induced by a relative motion between a part located in the material flow and influencing the electromagnetic alternating field and the electromagnetic alternating field in the detector coil, as well as means (7) for detecting a phase signal portion (PS'), characterized by means (12) for the formation of a locus curve from the detection signal, to which means the phase signal portion (PS) and the amplitude signal portion (AS) of the detection signal can be supplied, with the means (12) for the

formation of a locus curve being designed such that the progressions of the phase signal portion and the amplitude signal portion of the detection signal are plotted as pairs of variates at the respective points of time in a system of coordinates, the locus curve (15, 20, 30) being composed thereof, and by means (14) for the evaluation of the locus curve with respect to material-specific characteristics and for the emission of an identification signal (ES) upon detection of a material-specific characteristic.

14.   A device according to claim 13, characterized in that the means (12) for forming a locus curve and the means (14) for evaluating the locus curve are designed as a signal processor, in particular a digital signal processor (DSP), wherein the means (12) for forming a locus curve and the means (14) for evaluating the locus curve are preferably integral with each other.

15.   A device according to claim 13 or 14, characterized in that means (6) are provided for adjusting the amplitude signal portion (AS') via a nonlinear characteristic curve.

16.   A device according to any of claims 13 to 15, characterized in that means (8), preferably designed as rectifiers, are provided for the determination of an absolute value of the amplitude signal portion (AS'') and/or the phase signal portion of the detection signal (DS).

17.   A device according to any of claims 13 to 16, characterized in that a filter (5), preferably a band-pass filter, is provided for filtering out interfering signals in the detection signal (DS).

18.   A device according to any of claims 13 to 17, characterized in that a low-pass filter (9) is provided for forming the amplitude signal portion (AS''') and/or the phase signal portion of the detection signal (DS).

19.   A device according to any of claims 13 to 18, characterized in that the means (12) for evaluating the locus curve comprise image processing means.

20.   A device according to any of claims 13 to 19, characterized in that the means (12) for evaluating the locus curve comprise pattern recognition means.

21.   A device according to claim 20, characterized in that the means (12) for evaluating the locus curve are designed for the comparison of the locus curve (15, 20, 30) with a

predetermined, optionally adjustable, material-specific curve or a family of curves, wherein the individual curves of the family of curves preferably represent different purities, geometries or sizes of the detected part influencing the electromagnetic alternating field.

22.   A device according to claim 21, characterized in that the comparison of the locus curve (15, 20, 30) with a predetermined curve or family of curves includes the detection of at least one measured value of similarity and the comparison of the at least one measured value with at least one set value.

23.   A device according to any of claims 13 to 18, characterized in that the means (12) for evaluating the locus curve are designed for the determination of the position of characteristic points of the locus curve (15, 20, 30), preferably the inflection points (15a, 15b; 21; 31, 32) or extrema (15c) thereof, and for the comparison of these positions with standard positions or limiting values or fringe ranges (16a, 16b), respectively.

24.   A device according to any of claims 13 to 23, characterized in that the identification signal (ES) is a material-specific identification signal.

25.   A device according to any of claims 13 to 24, characterized in that the identification signal (ES) is configured for activating means for the separation of the detected part influencing the electromagnetic alternating field from the material flow.

26.   A device according to any of claims 13 to 25, characterized in that a plurality of transmitting coils (2) and detector coils (4) are arranged across the conveying distance of the material flow, wherein one transmitting coil (2) at a time is allocated to a detector coil (4) and the detection signals of the detector coils are formed into locus curves and evaluated independently of each other.